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*Science and Technology for Tomorrow's Aerospace Forces*

## **Success Story**

### **ELECTRONIC DEVICES FABRICATED USING NITRIDE-BASED MATERIAL**



The Sensors Directorate in-house project teams are investigating nitride-based technology. These teams leverage in-house capabilities, contractual efforts, commercial developments, and diverse funding sources in a collaborative and complementary program of technology development. New nitride-based devices can potentially reduce system level aperture size by 1.8 times and improve range by 80%. This technology will also improve efficiency by a threefold reduction of prime power and thermal management, and a twofold reduction in mass and volume, and will reduce the overall cost of the aerospace subsystems.



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## **Accomplishment**

A team of scientists from the directorate, industry, and academia investigated fabricating electronic devices using nitride-based material. The collaboration achieved a record output power of 40 watts (W) at 10 gigahertz from a single solid-state device (greater than 2.5 times conventional) and record power density of 9.8 W/mm (greater than 10 times conventional).

## **Background**

Unlike conventional technology using silicon or gallium arsenide, nitride-based devices are more robust when exposed to extreme temperature and radiation environments. In addition, the unique properties of nitride-based devices help them sustain very high voltages, typically more than 200 V, and high current densities greater than 1 amp per mm. Therefore, nitride-based devices should operate under direct exposure to a harsh environment while also subjected to hostile input signals.

Advanced unmanned aerial vehicles and space platforms need electronic devices that operate in a very hostile environment with low mass and reduced volume. Commercial industry investigated nitride-based technology for several years with particular emphasis on light-emitting diodes for lighting. The results show great promise for military applications because of their wide bandgap properties.

With increased power density, nitride-based devices also have unique power characteristics that would enhance microwave amplifier technology. Leveraging commercial industry research, the directorate initiated an in-house nitride device project team to examine the possibilities of a robust nitride-based technology for critical military applications.

Nitride-based devices, when inserted into sensor applications, should enable new operational capabilities for the warfighter. These systems require limited volume, reduced mass, and limited environmental control, and include examples such as Sensor Craft, unmanned aerial vehicles, space-based radar, communications links, and electronic warfare. The characteristics noted offer a solution to the technical barriers associated with radio frequency apertures.

## **Additional information**

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTT, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (01-SN-04)